FIG.1

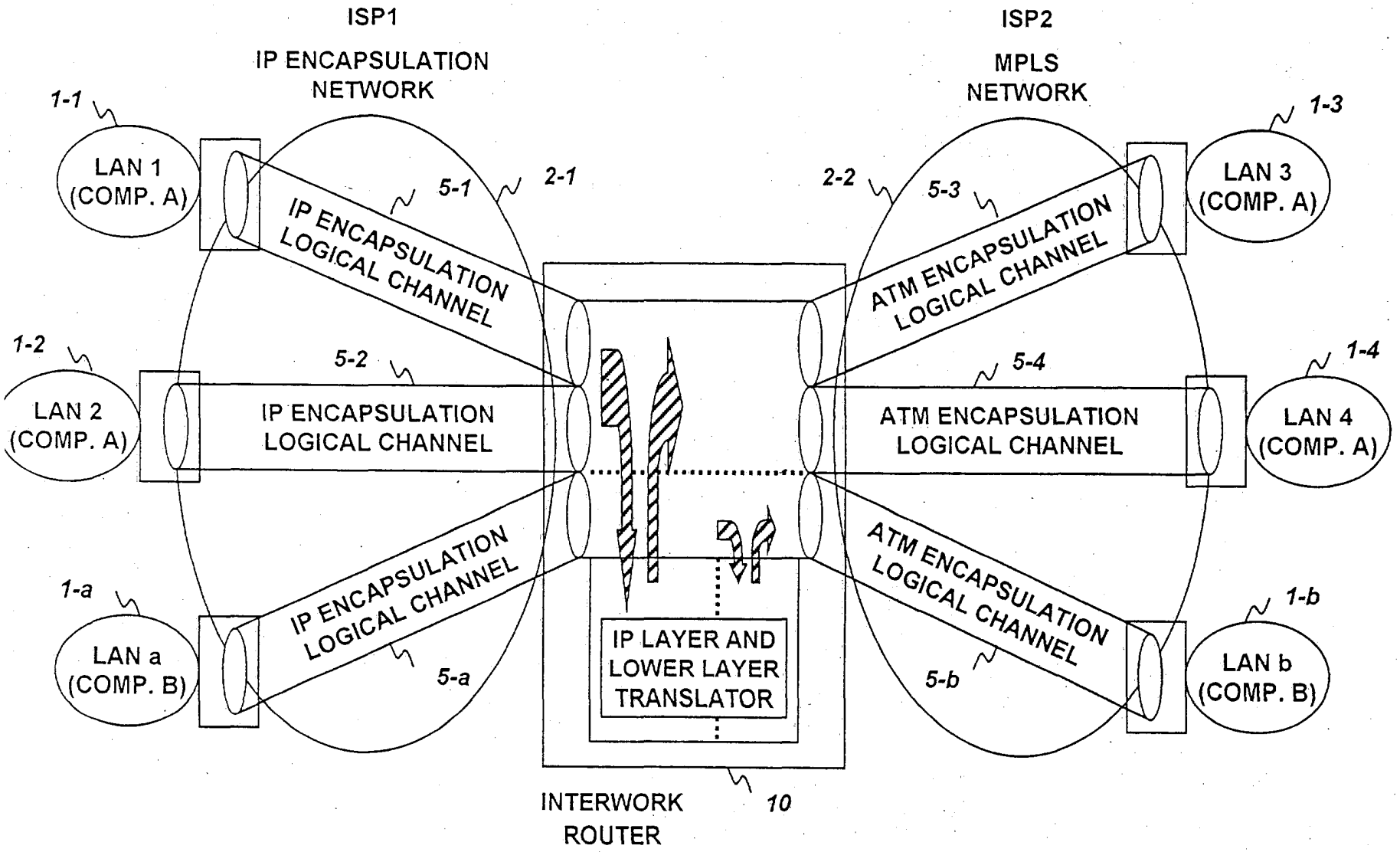

ISP1
IP ENCAPSULATION NETWORK
ISP2
MPLS NETWORK
1-1
LAN 1 (COMP. A)
1-2
LAN 2 (COMP. A)
1-a
LAN a (COMP. B)
1-3
LAN 3 (COMP. A)
1-4
LAN 4 (COMP. A)
1-b
LAN b (COMP. B)
2-1
2-2
5-1
IP ENCAPSULATION LOGICAL CHANNEL
5-2
IP ENCAPSULATION LOGICAL CHANNEL
5-a
IP ENCAPSULATION LOGICAL CHANNEL
5-3
ATM ENCAPSULATION LOGICAL CHANNEL
5-4
ATM ENCAPSULATION LOGICAL CHANNEL
5-b
ATM ENCAPSULATION LOGICAL CHANNEL
IP LAYER AND LOWER LAYER TRANSLATOR
INTERWORK ROUTER
10

FIG.2

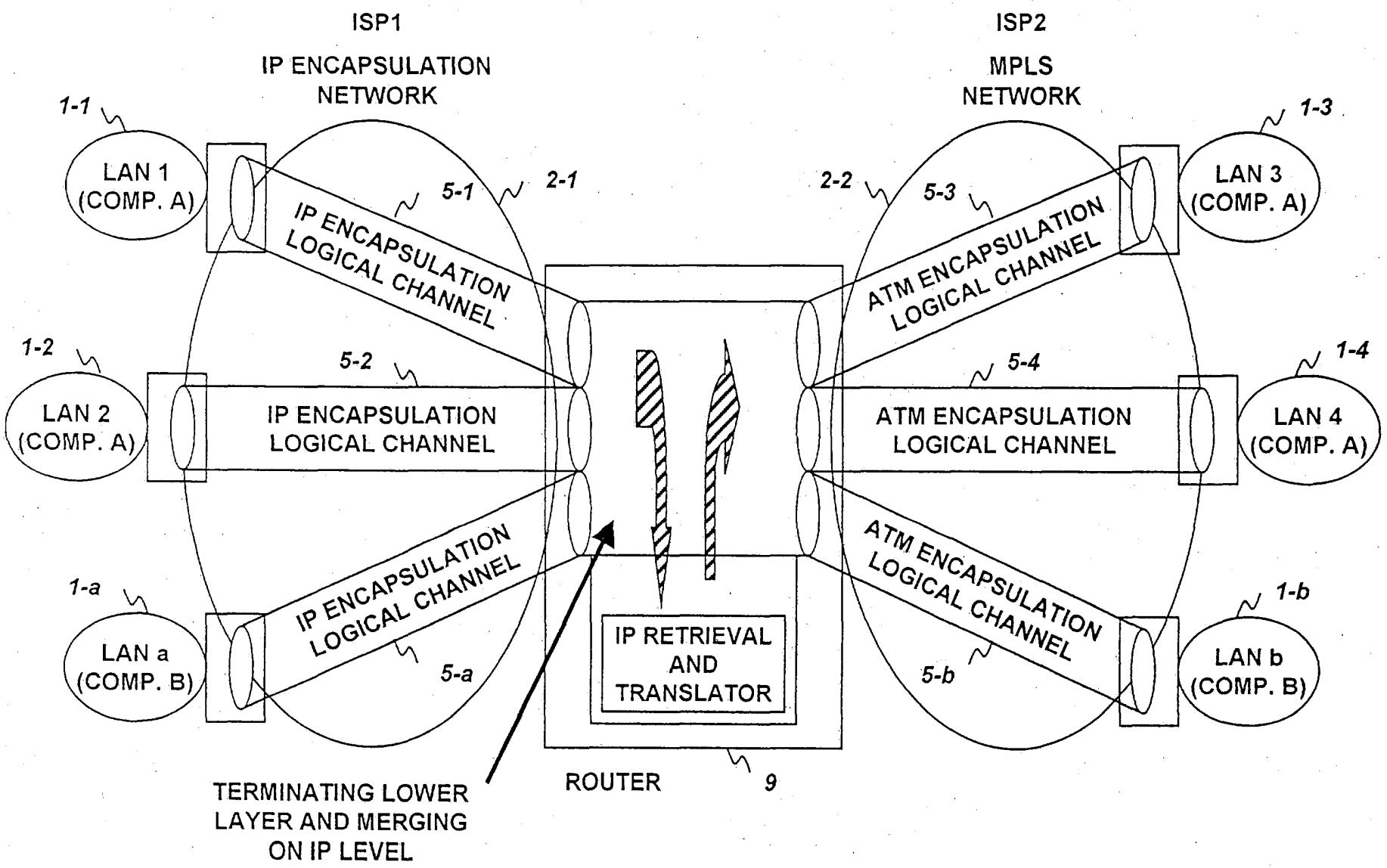

ISP1
IP ENCAPSULATION NETWORK
ISP2
MPLS NETWORK
1-1
LAN 1 (COMP. A)
1-2
LAN 2 (COMP. A)
1-a
LAN a (COMP. B)
1-3
LAN 3 (COMP. A)
1-4
LAN 4 (COMP. A)
1-b
LAN b (COMP. B)
2-1
2-2
5-1
IP ENCAPSULATION LOGICAL CHANNEL
5-2
IP ENCAPSULATION LOGICAL CHANNEL
5-a
IP ENCAPSULATION LOGICAL CHANNEL
5-3
ATM ENCAPSULATION LOGICAL CHANNEL
5-4
ATM ENCAPSULATION LOGICAL CHANNEL
5-b
ATM ENCAPSULATION LOGICAL CHANNEL
IP RETRIEVAL AND TRANSLATOR
ROUTER
9
TERMINATING LOWER LAYER AND MERGING ON IP LEVEL

FIG.3

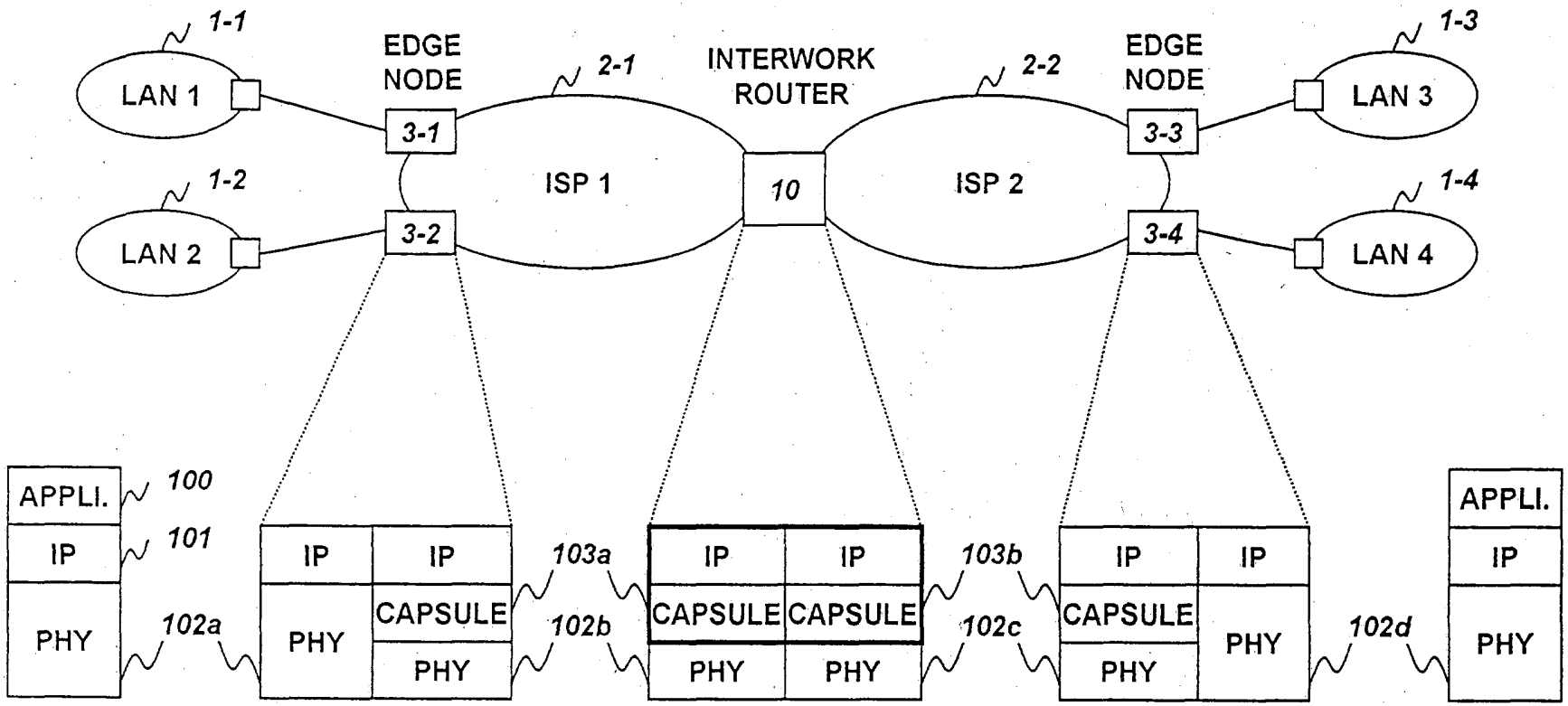
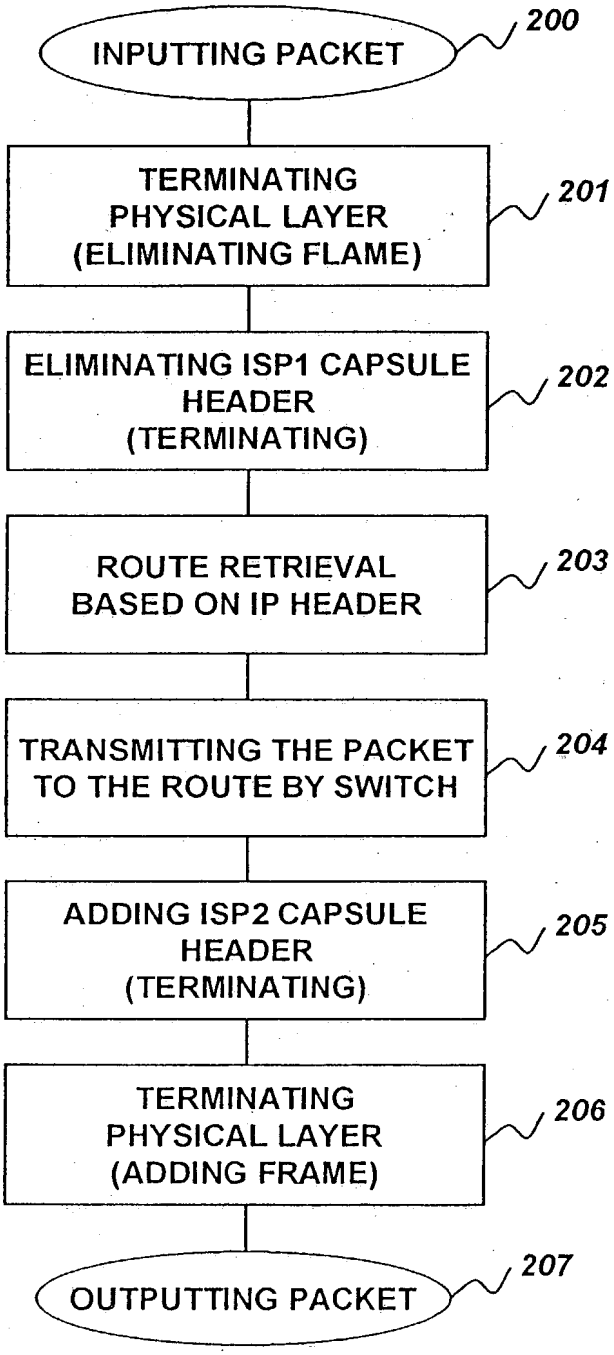
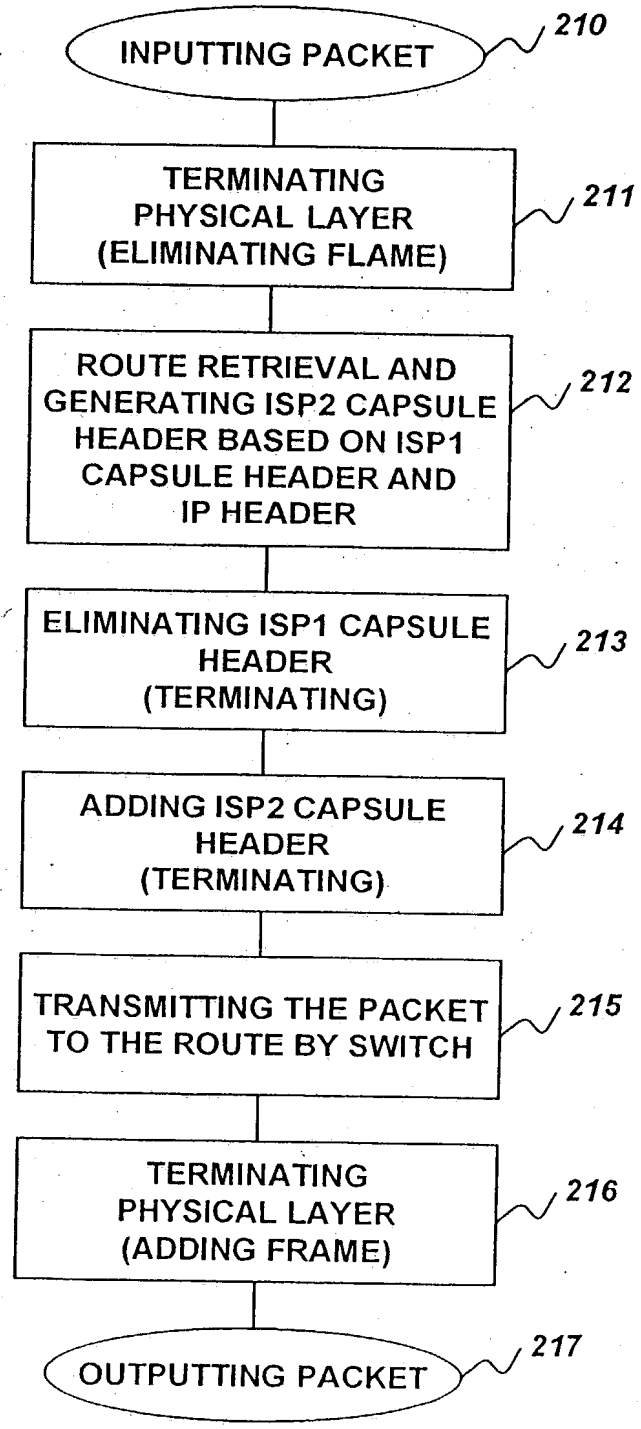

1-1
LAN 1
EDGE NODE
3-1
2-1
INTERWORK ROUTER
2-2
EDGE NODE
3-3
1-3
LAN 3
1-2
LAN 2
3-2
ISP 1
10
ISP 2
3-4
1-4
LAN 4
APPLI.
100
IP
101
PHY
102a
IP
IP
PHY
CAPSULE
PHY
103a
IP
IP
CAPSULE
CAPSULE
PHY
PHY
102b
103b
102c
IP
IP
CAPSULE
PHY
PHY
102d
APPLI.
IP
PHY

FIG.4



PROCESSING FLOW IN ROUTER

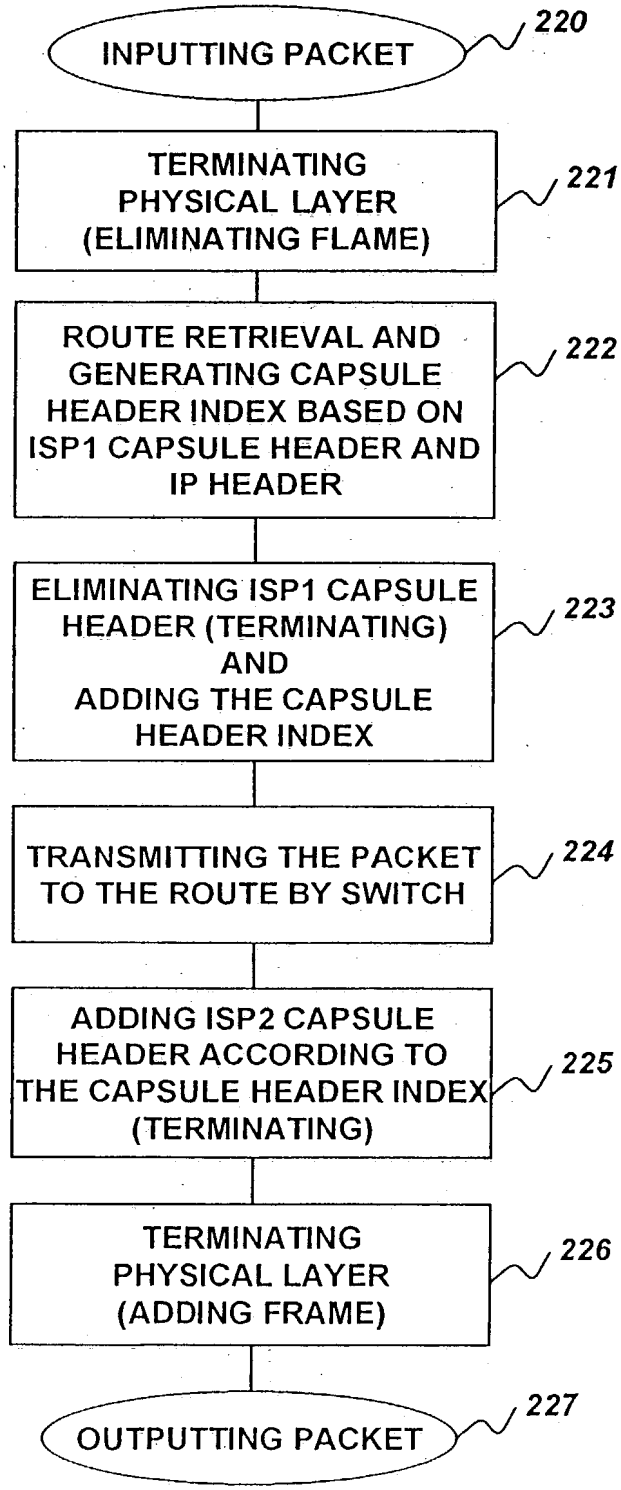
FIG.5



PROCESSING FLOW

IN INTERWORK ROUTER

FIG.6



PROCESSING FLOW

IN INTERWORK ROUTER

FIG.7

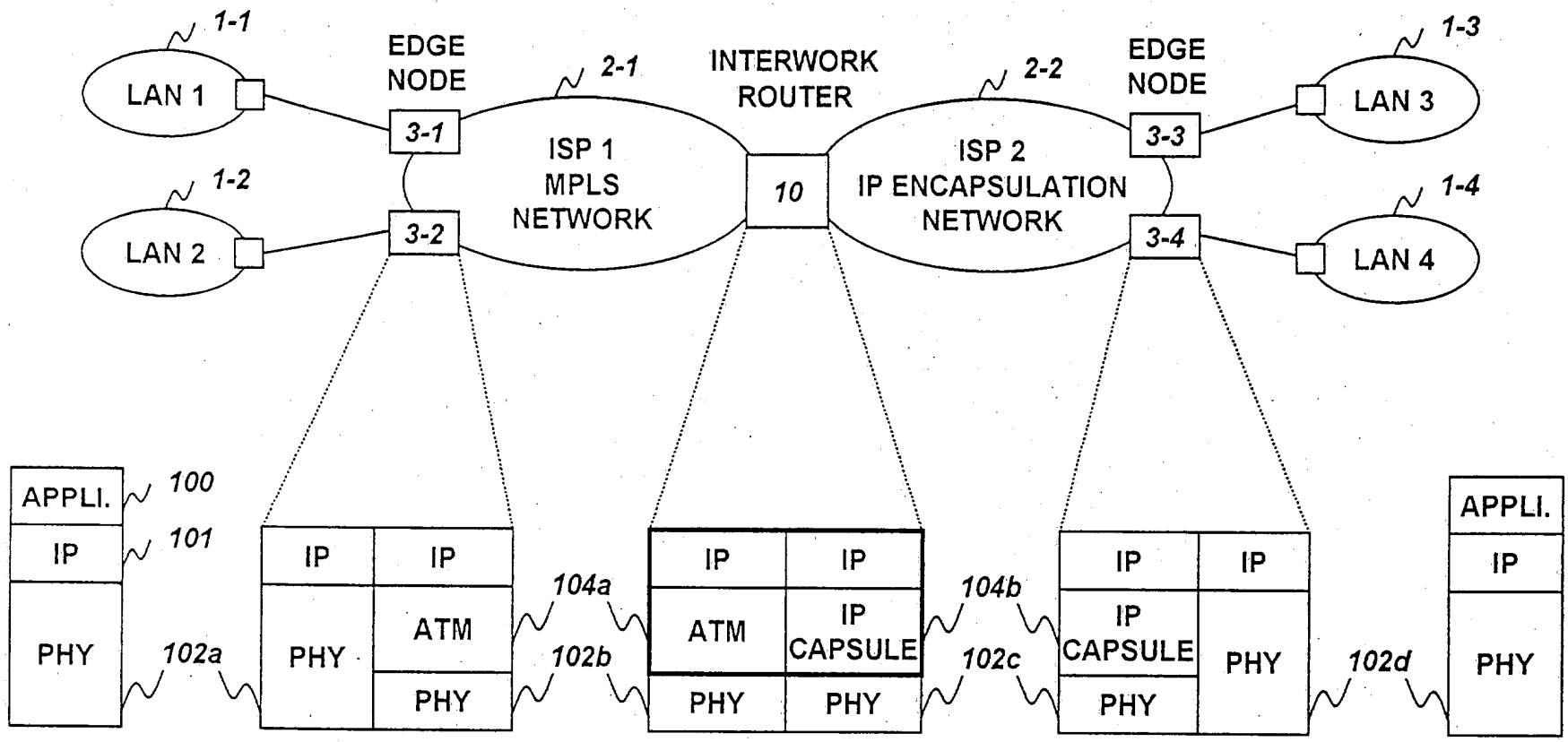
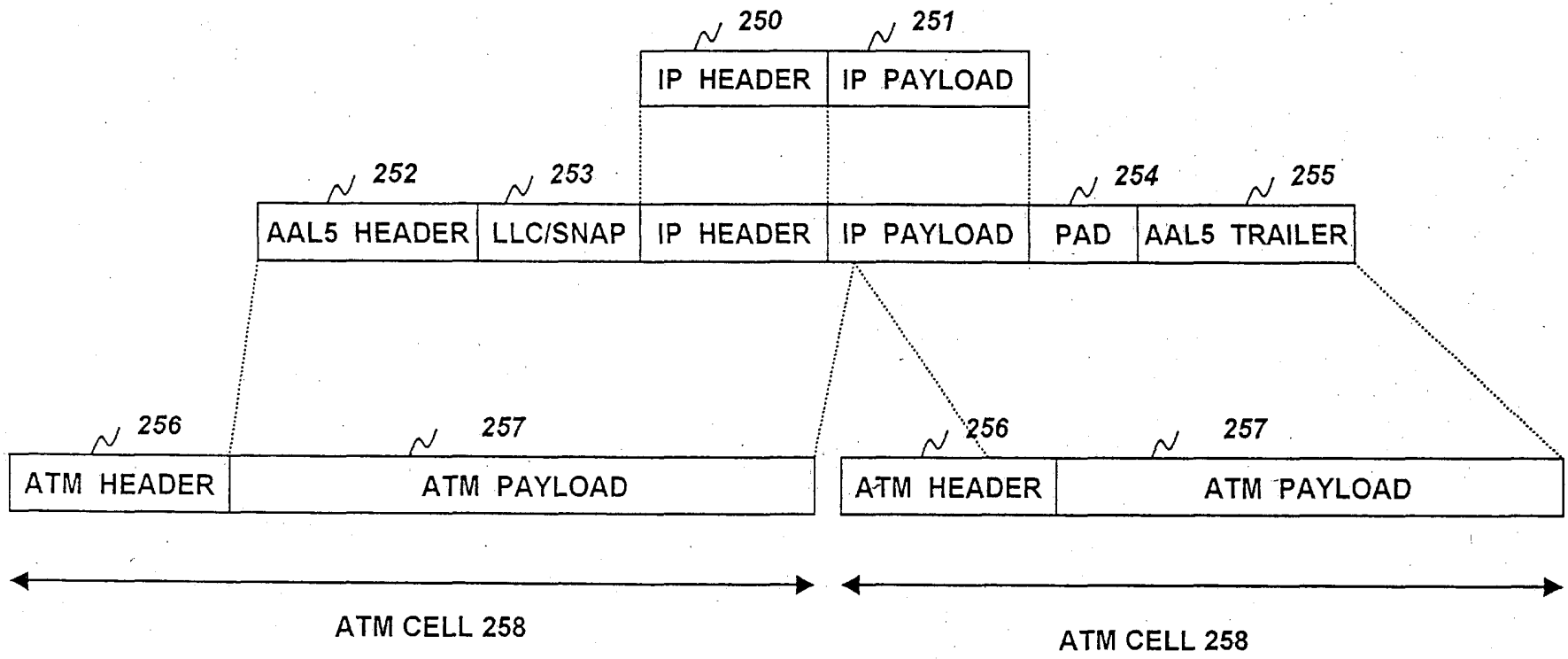

1-1
LAN 1
EDGE NODE
3-1
2-1
ISP 1 MPLS NETWORK
INTERWORK ROUTER
10
2-2
ISP 2 IP ENCAPSULATION NETWORK
EDGE NODE
3-3
1-3
LAN 3
1-2
LAN 2
3-2
3-4
1-4
LAN 4
APPLI.
100
IP
101
PHY
102a
IP
IP
PHY
ATM
PHY
104a
102b
IP
IP
ATM
IP CAPSULE
PHY
PHY
104b
102c
IP
IP
IP CAPSULE
PHY
PHY
102d
APPLI.
IP
PHY

FIG.8



ENCAPSULATION BY AAL5 (RFC 1483)

FIG.9

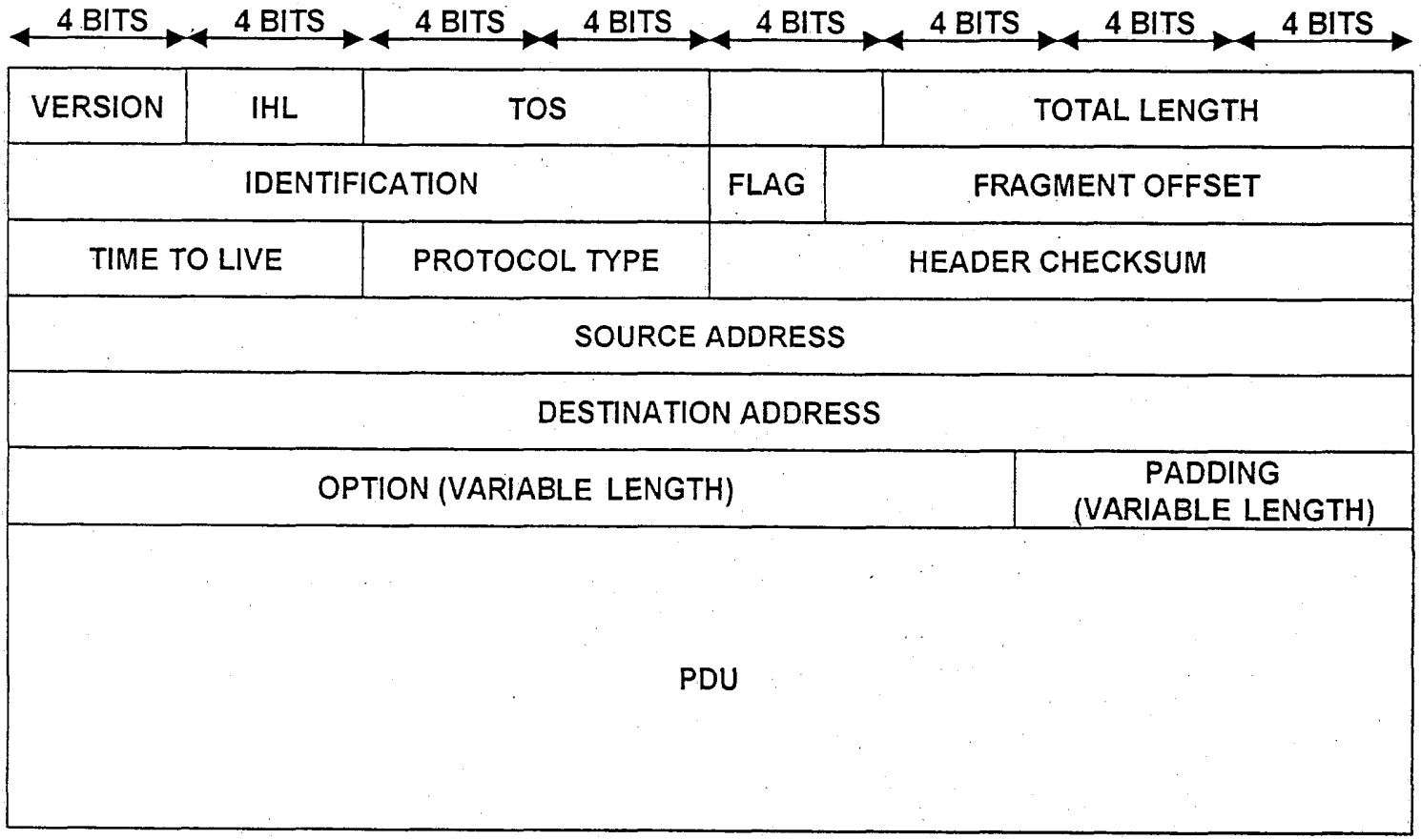
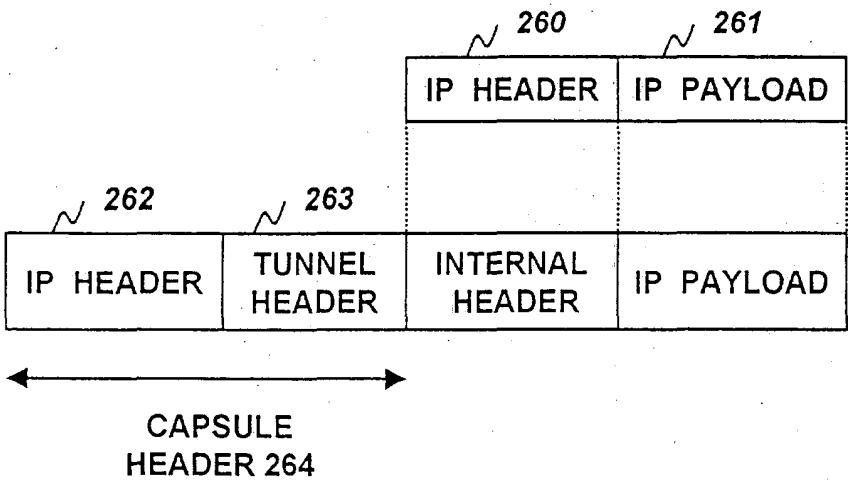

4 BITS
4 BITS
4 BITS
4 BITS
4 BITS
4 BITS
4 BITS
4 BITS
VERSION
IHL
TOS
TOTAL LENGTH
IDENTIFICATION
FLAG
FRAGMENT OFFSET
TIME TO LIVE
PROTOCOL TYPE
HEADER CHECKSUM
SOURCE ADDRESS
DESTINATION ADDRESS
OPTION (VARIABLE LENGTH)
PADDING
(VARIABLE LENGTH)
PDU

FIG.10



ENCAPSULATION BY IP TUNNEL (RFC 1853)

FIG.11

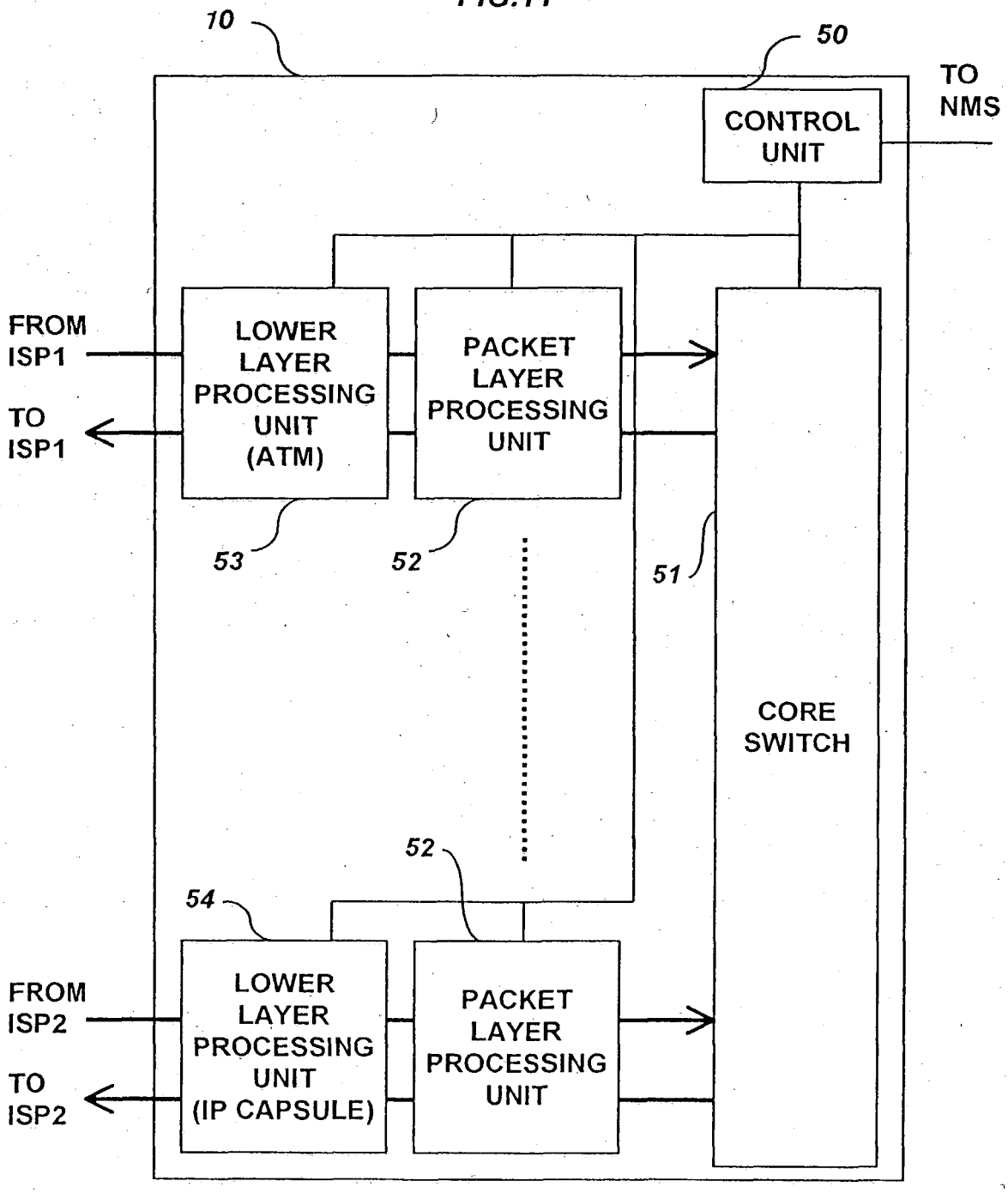

10
50
TO NMS
CONTROL UNIT
FROM ISP1
TO ISP1
LOWER LAYER PROCESSING UNIT (ATM)
PACKET LAYER PROCESSING UNIT
53
52
51
CORE SWITCH
52
54
FROM ISP2
TO ISP2
LOWER LAYER PROCESSING UNIT (IP CAPSULE)
PACKET LAYER PROCESSING UNIT

FIG.12

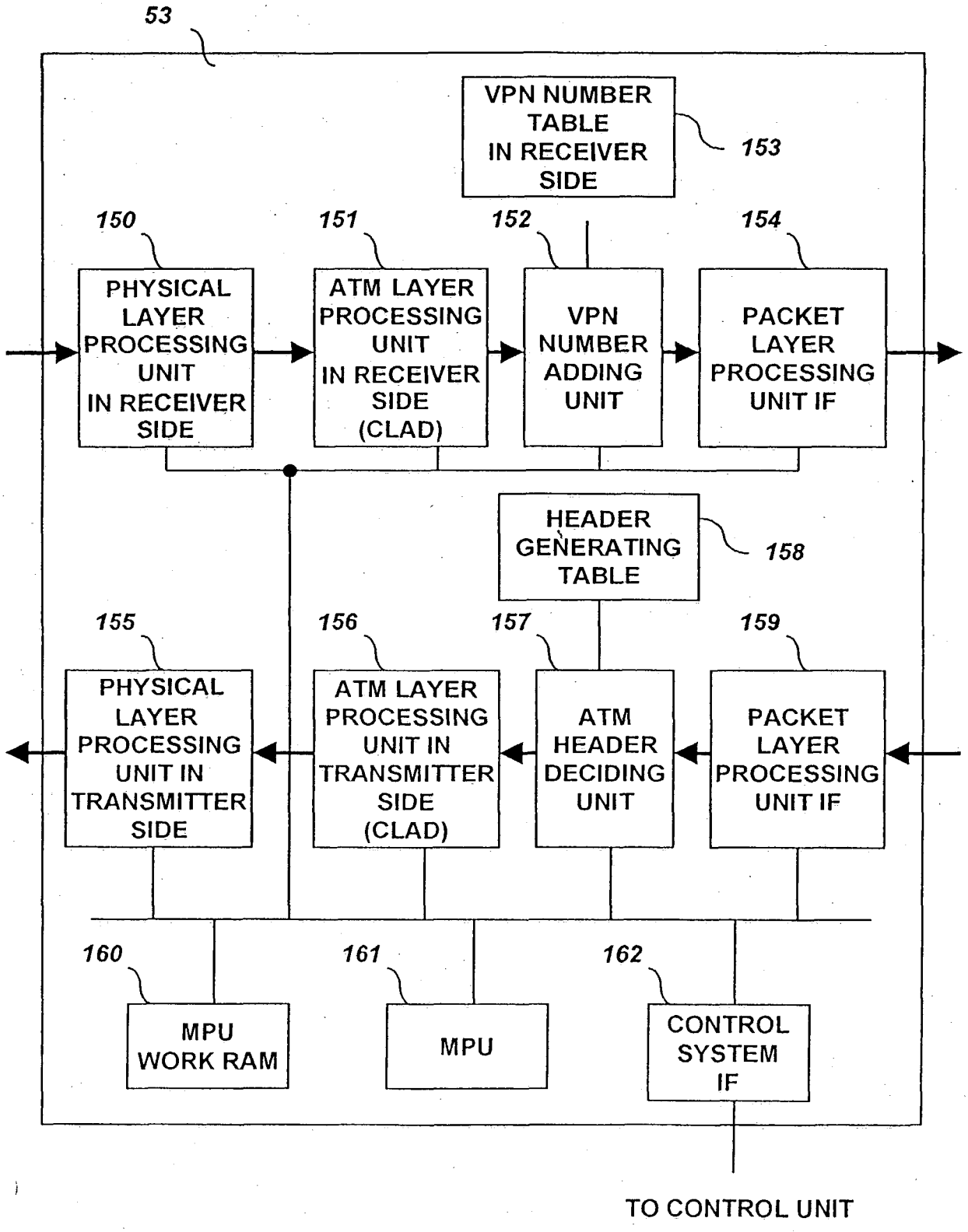

53
VPN NUMBER TABLE IN RECEIVER SIDE
153
150
151
152
154
PHYSICAL LAYER PROCESSING UNIT IN RECEIVER SIDE
ATM LAYER PROCESSING UNIT IN RECEIVER SIDE (CLAD)
VPN NUMBER ADDING UNIT
PACKET LAYER PROCESSING UNIT IF
HEADER GENERATING TABLE
158
155
156
157
159
PHYSICAL LAYER PROCESSING UNIT IN TRANSMITTER SIDE
ATM LAYER PROCESSING UNIT IN TRANSMITTER SIDE (CLAD)
ATM HEADER DECIDING UNIT
PACKET LAYER PROCESSING UNIT IF
160
161
162
MPU WORK RAM
MPU
CONTROL SYSTEM IF
TO CONTROL UNIT

FIG.13

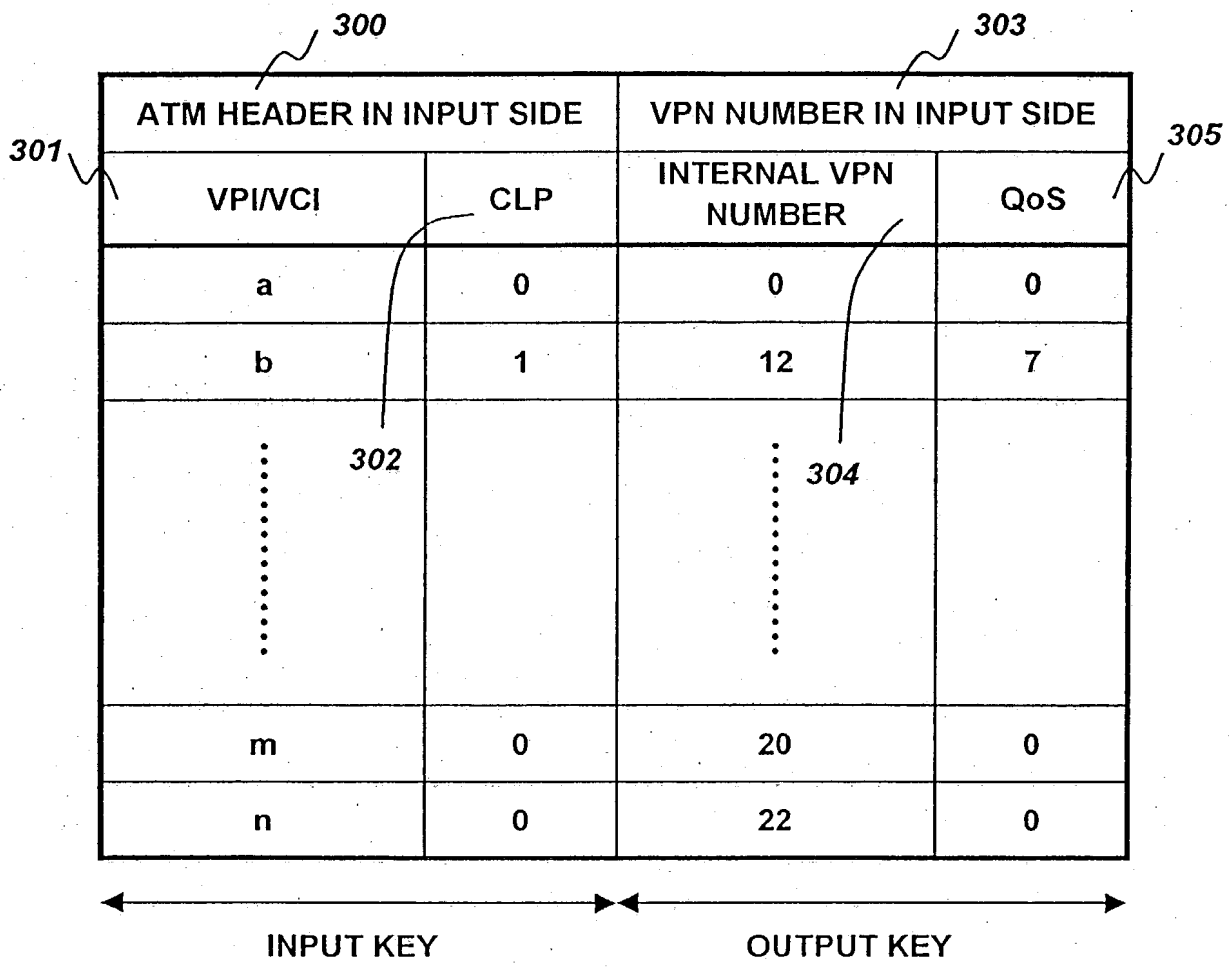

300
303
ATM HEADER IN INPUT SIDE
VPN NUMBER IN INPUT SIDE
301
305
VPI/VCI
CLP
INTERNAL VPN NUMBER
QoS
302
304
a
0
0
0
b
1
12
7
m
0
20
0
n
0
22
0
INPUT KEY
OUTPUT KEY

FIG.14

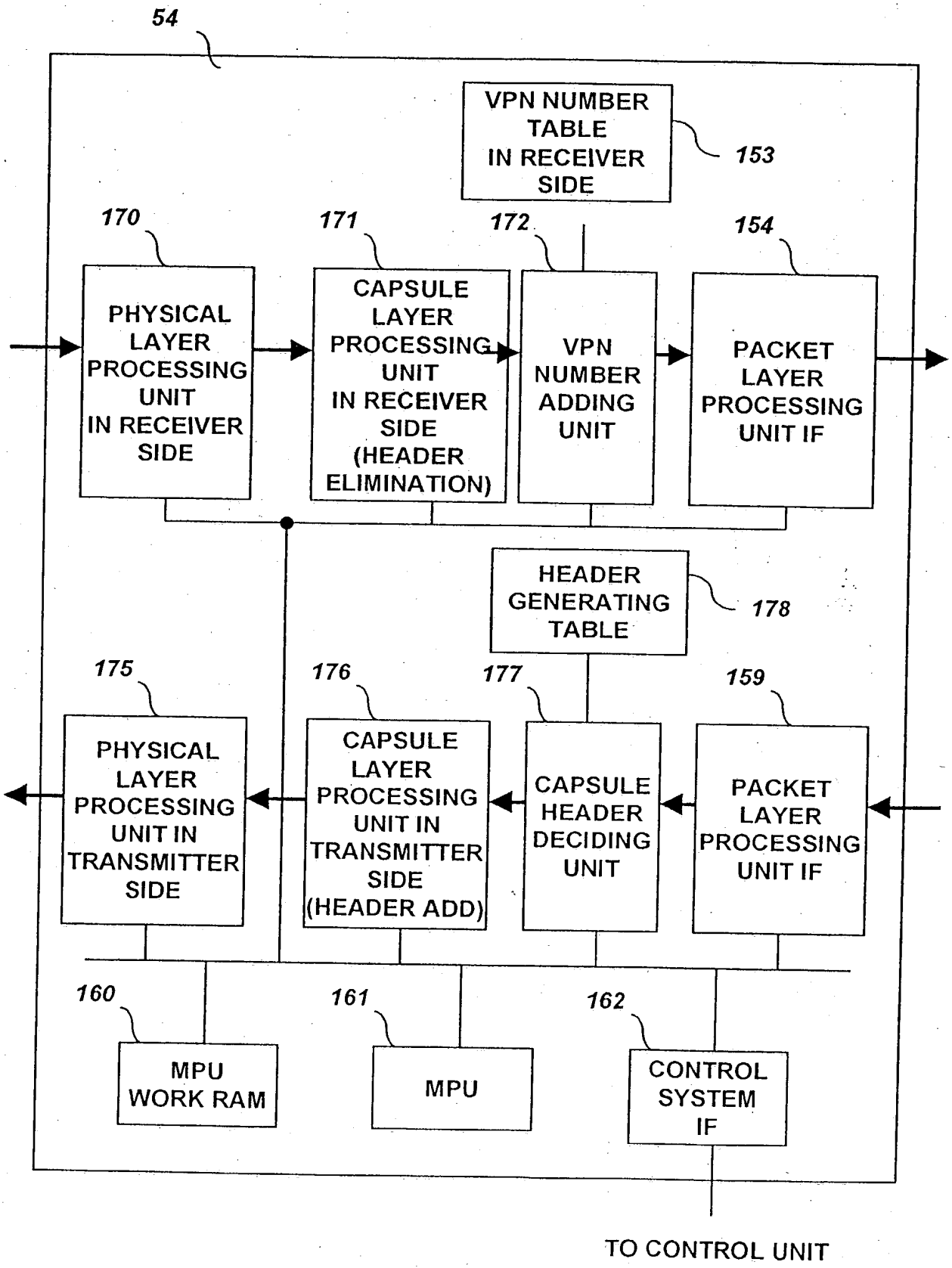

54
VPN NUMBER TABLE IN RECEIVER SIDE
153
170
171
172
154
PHYSICAL LAYER PROCESSING UNIT IN RECEIVER SIDE
CAPSULE LAYER PROCESSING UNIT IN RECEIVER SIDE (HEADER ELIMINATION)
VPN NUMBER ADDING UNIT
PACKET LAYER PROCESSING UNIT IF
HEADER GENERATING TABLE
178
175
176
177
159
PHYSICAL LAYER PROCESSING UNIT IN TRANSMITTER SIDE
CAPSULE LAYER PROCESSING UNIT IN TRANSMITTER SIDE (HEADER ADD)
CAPSULE HEADER DECIDING UNIT
PACKET LAYER PROCESSING UNIT IF
160
161
162
MPU WORK RAM
MPU
CONTROL SYSTEM IF
TO CONTROL UNIT

FIG.15

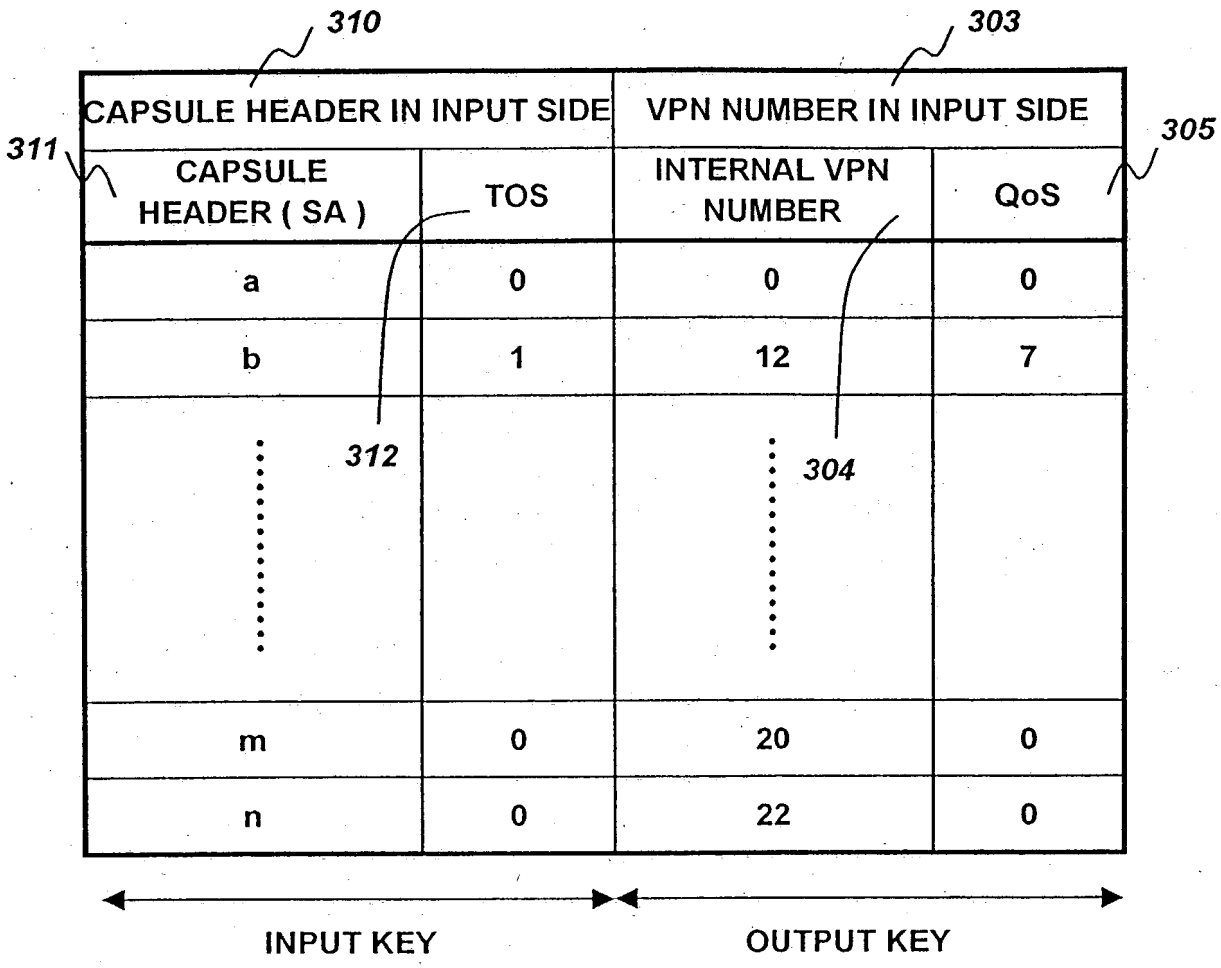

310
303
CAPSULE HEADER IN INPUT SIDE
VPN NUMBER IN INPUT SIDE
311
305
CAPSULE HEADER (SA)
TOS
INTERNAL VPN NUMBER
QoS
a
0
0
0
b
1
12
7
312
304
m
0
20
0
n
0
22
0
INPUT KEY
OUTPUT KEY

FIG.16

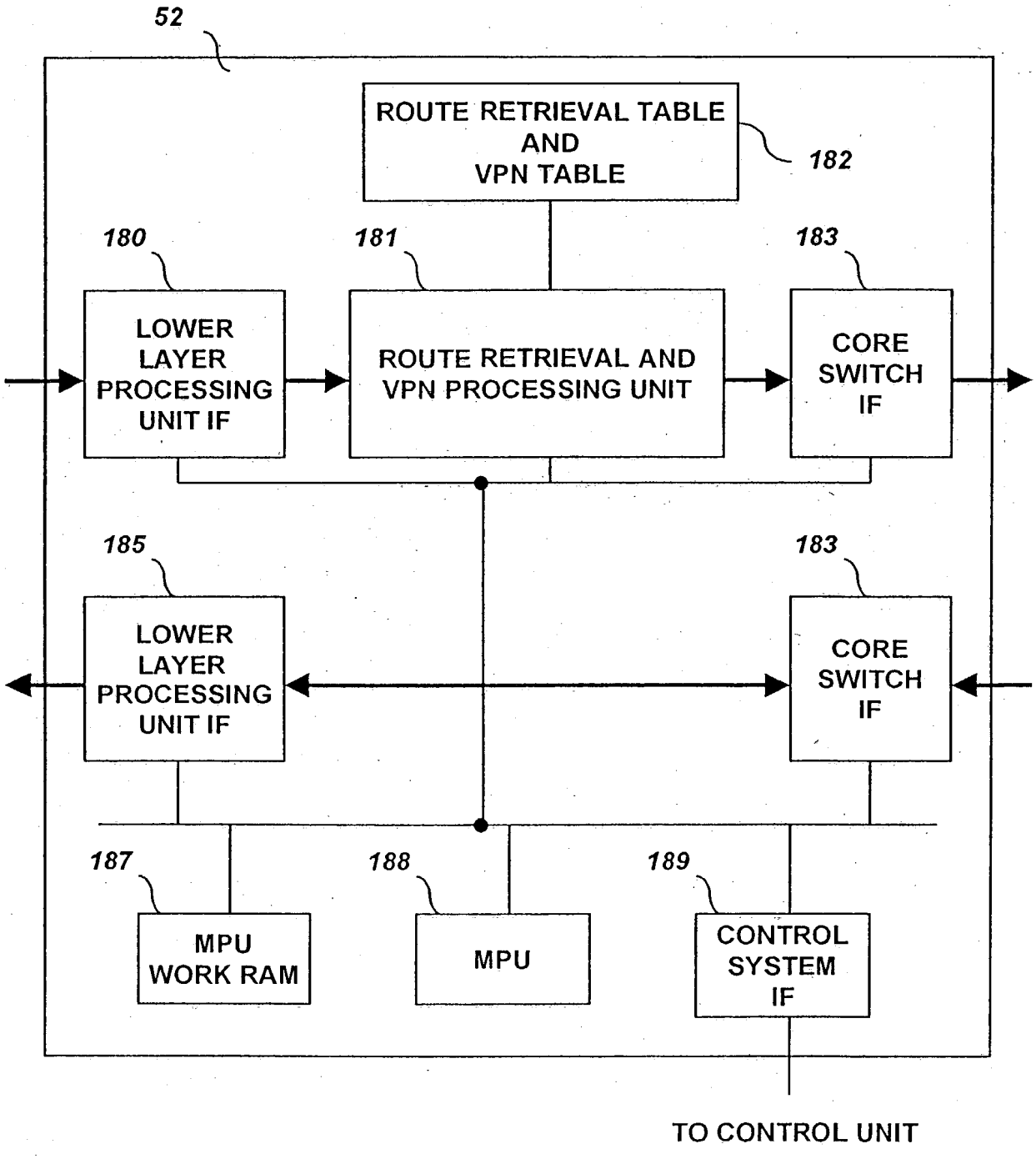

52
ROUTE RETRIEVAL TABLE AND VPN TABLE
182
180
181
183
LOWER LAYER PROCESSING UNIT IF
ROUTE RETRIEVAL AND VPN PROCESSING UNIT
CORE SWITCH IF
185
183
LOWER LAYER PROCESSING UNIT IF
CORE SWITCH IF
187
188
189
MPU WORK RAM
MPU
CONTROL SYSTEM IF
TO CONTROL UNIT

FIG.17

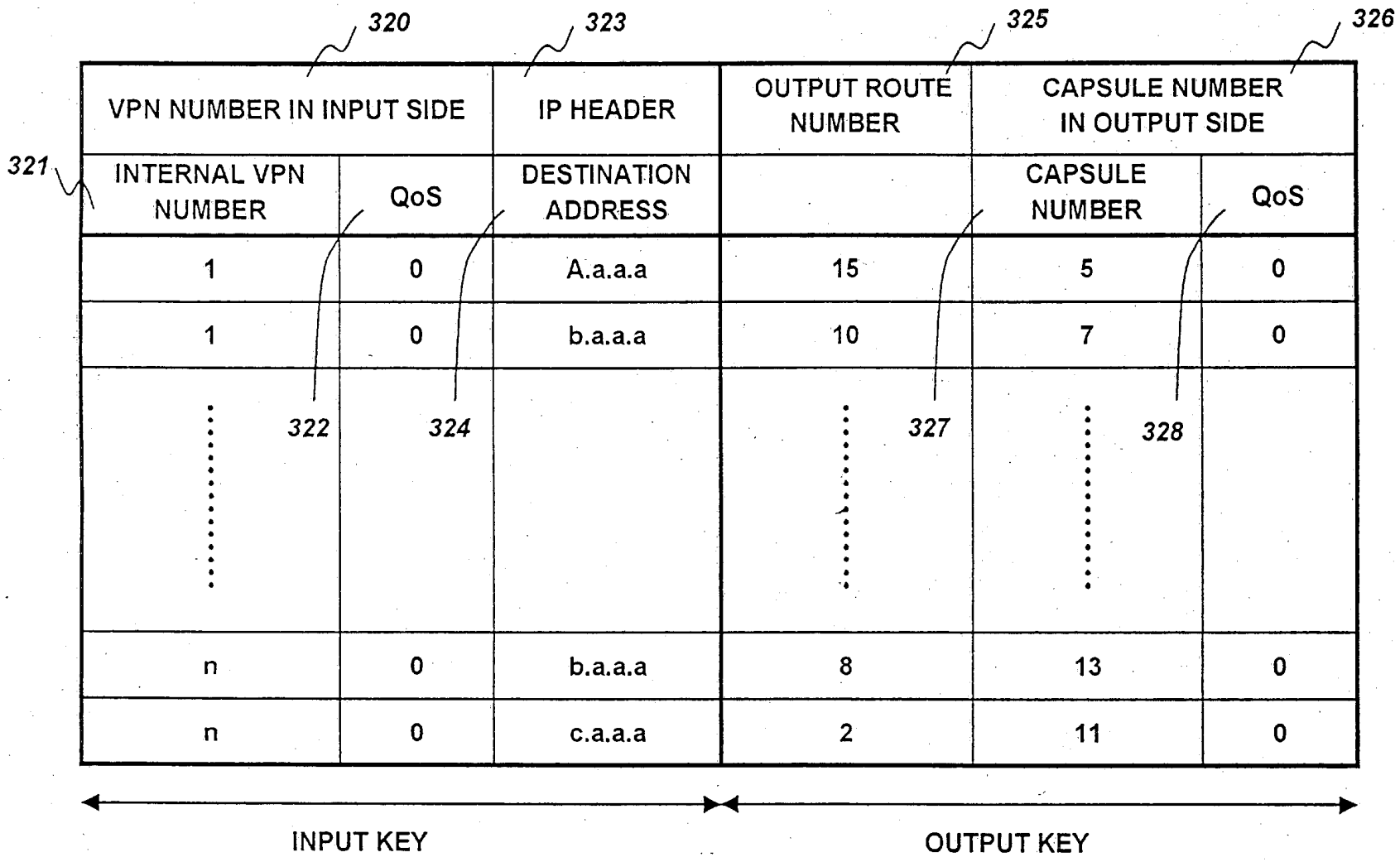

320
323
325
326
VPN NUMBER IN INPUT SIDE
IP HEADER
OUTPUT ROUTE NUMBER
CAPSULE NUMBER IN OUTPUT SIDE
321
INTERNAL VPN NUMBER
QoS
DESTINATION ADDRESS
CAPSULE NUMBER
QoS
1 0 A.a.a.a 15 5 0
1 0 b.a.a.a 10 7 0
322
324
327
328
n 0 b.a.a.a 8 13 0
n 0 c.a.a.a 2 11 0
INPUT KEY
OUTPUT KEY

FIG.18

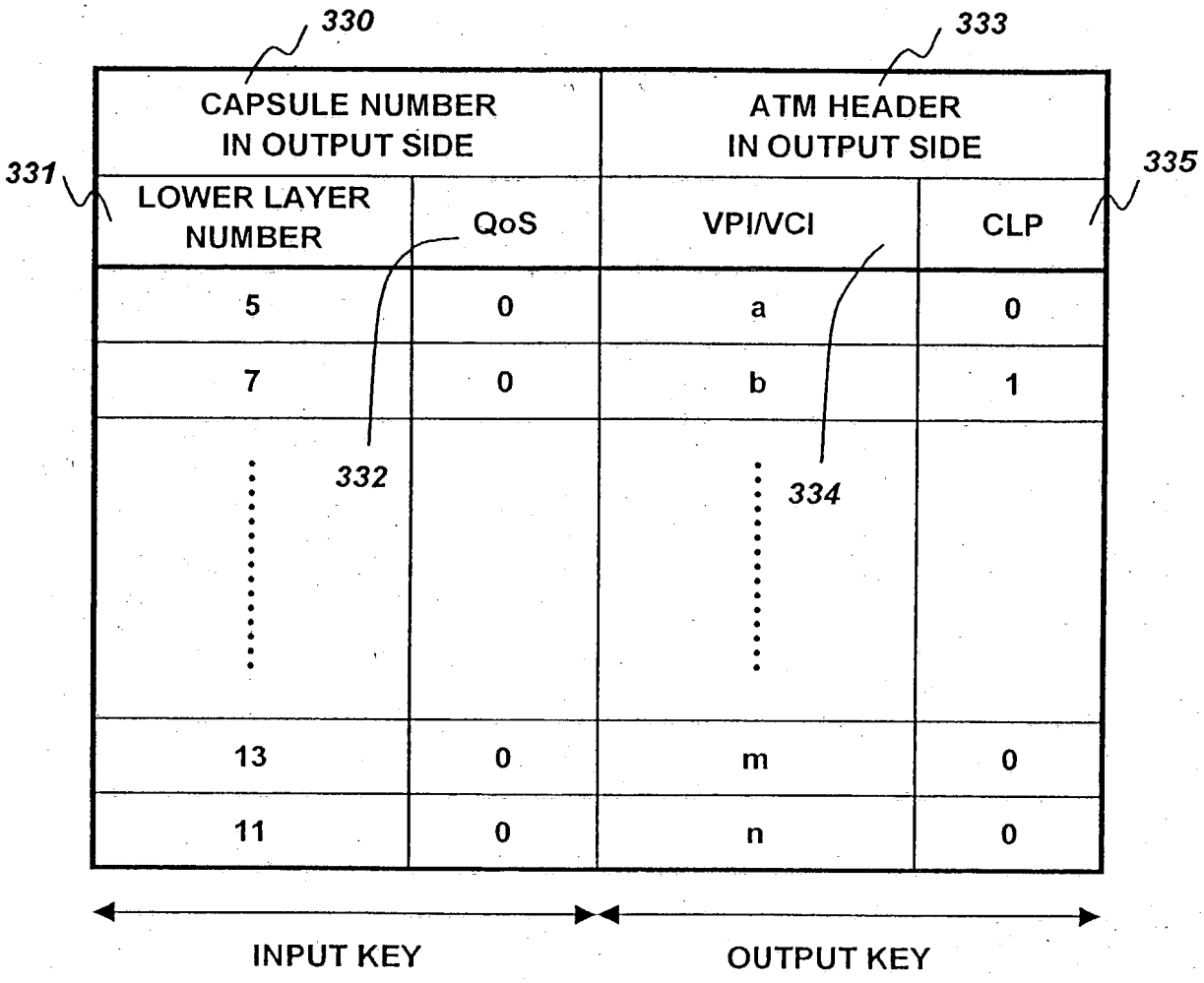

330
333
CAPSULE NUMBER IN OUTPUT SIDE
ATM HEADER IN OUTPUT SIDE
331
335
LOWER LAYER NUMBER
QoS
VPI/VCI
CLP
5
0
a
0
7
0
b
1
332
334
13
0
m
0
11
0
n
0
INPUT KEY
OUTPUT KEY

FIG.19

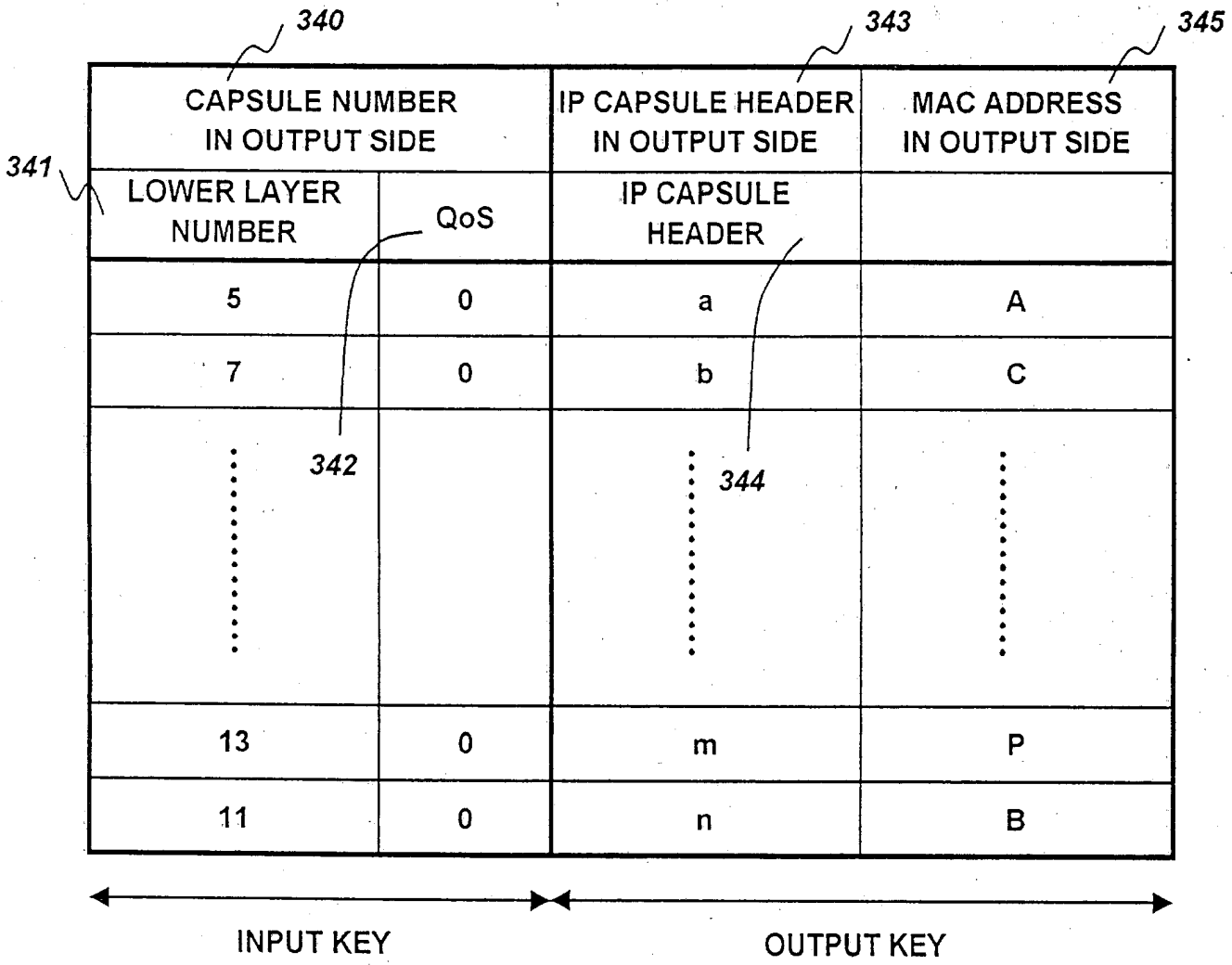

340
343
345
CAPSULE NUMBER IN OUTPUT SIDE
IP CAPSULE HEADER IN OUTPUT SIDE
MAC ADDRESS IN OUTPUT SIDE
341
LOWER LAYER NUMBER
QoS
IP CAPSULE HEADER
342
344
5
0
a
A
7
0
b
C
13
0
m
P
11
0
n
B
INPUT KEY
OUTPUT KEY

FIG.20

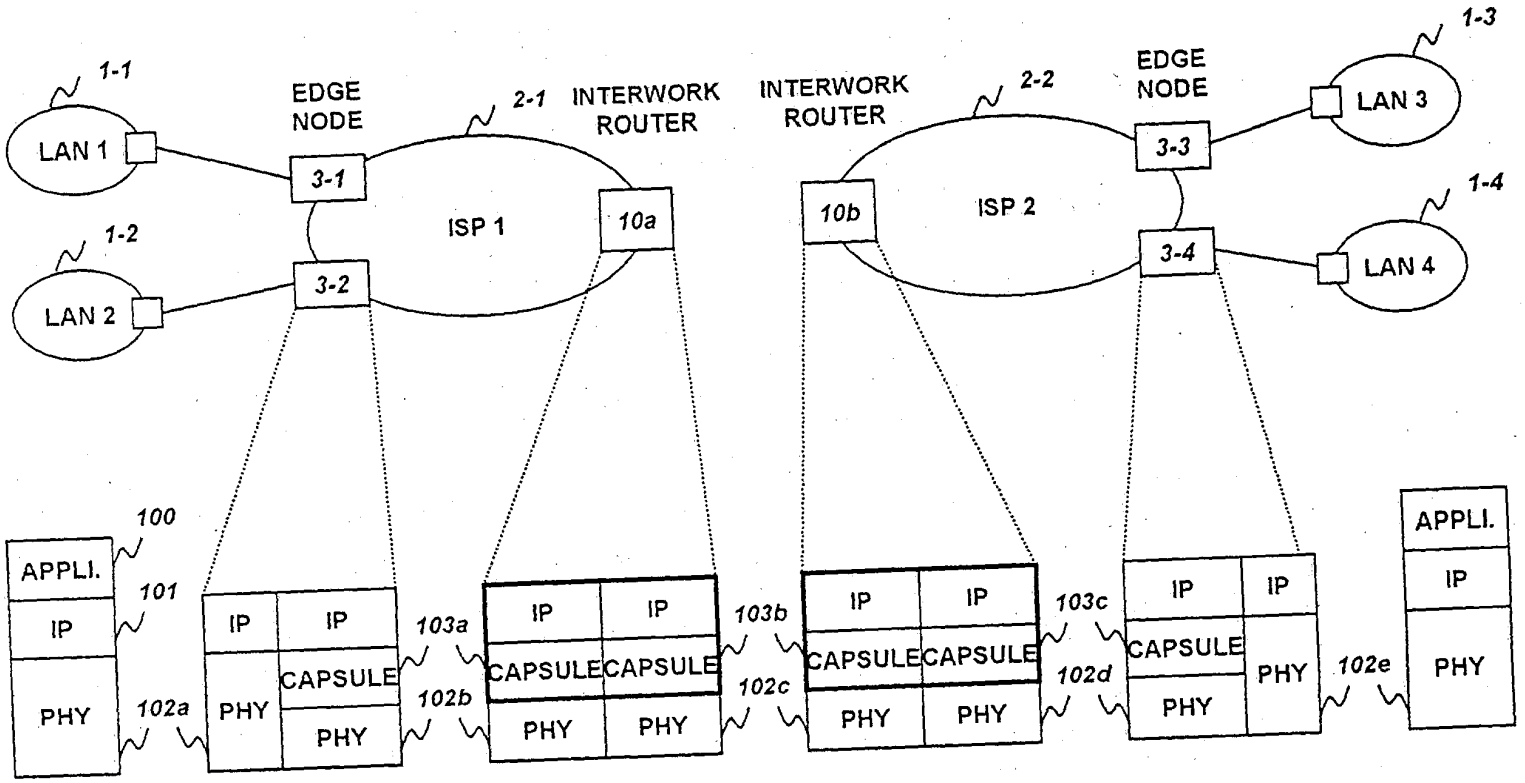

1-1
LAN 1
EDGE NODE
3-1
2-1
INTERWORK ROUTER
ISP 1
10a
1-2
LAN 2
3-2
INTERWORK ROUTER
2-2
EDGE NODE
1-3
LAN 3
3-3
10b
ISP 2
1-4
LAN 4
3-4
100
APPLI.
IP
101
PHY
102a
IP
IP
CAPSULE
PHY
103a
IP
IP
CAPSULE
CAPSULE
PHY
PHY
102b
103b
102c
IP
IP
CAPSULE
CAPSULE
PHY
PHY
103c
102d
IP
IP
CAPSULE
PHY
PHY
102e
APPLI.
IP
PHY

FIG.21

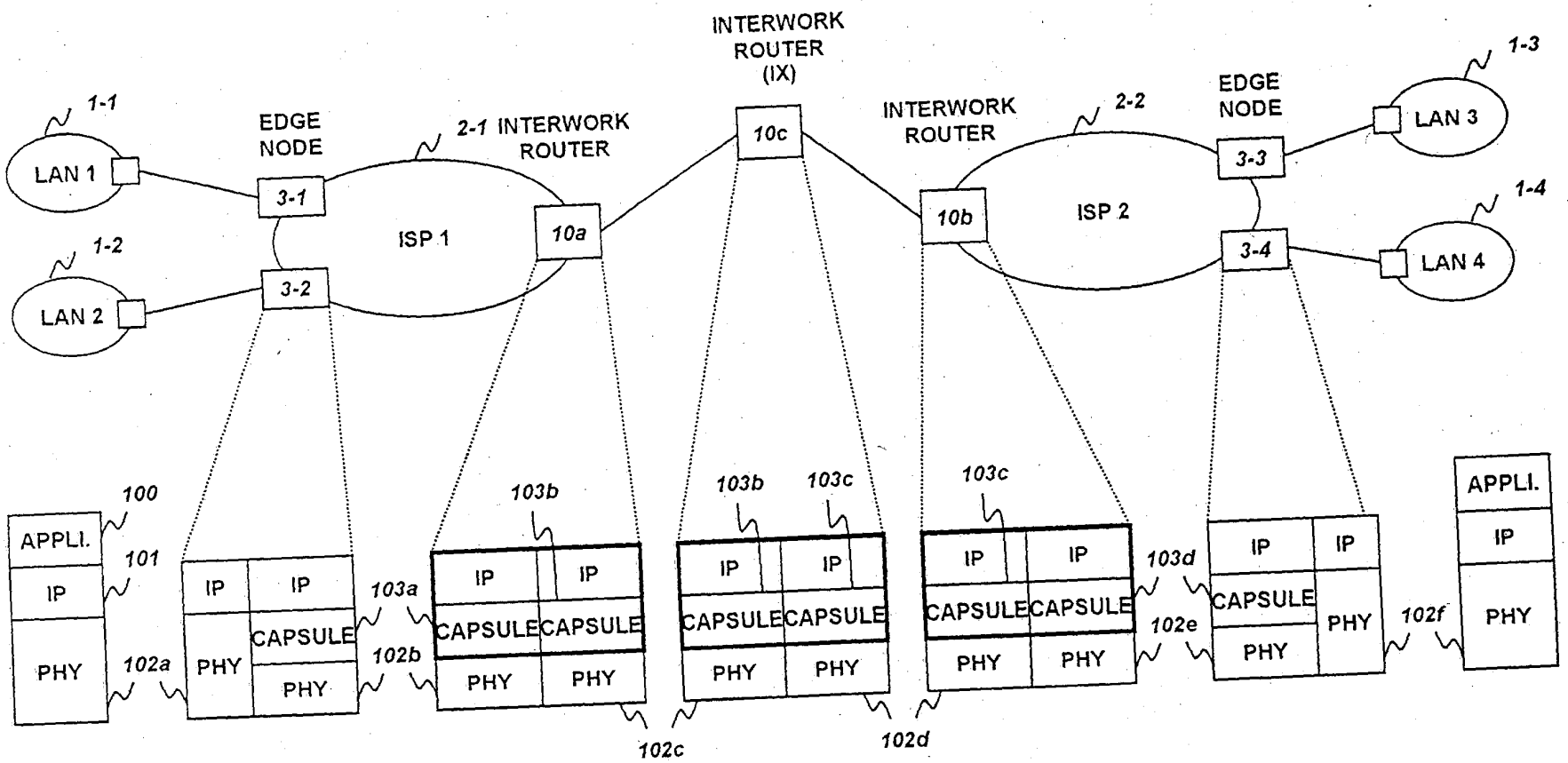

INTERWORK ROUTER (IX)
1-1
LAN 1
EDGE NODE
3-1
2-1 INTERWORK ROUTER
ISP 1
10a
10c
INTERWORK ROUTER
2-2
EDGE NODE
1-3
LAN 3
3-3
10b
ISP 2
1-4
LAN 4
3-4
1-2
LAN 2
3-2
100
APPLI.
101
IP
PHY
102a
IP
IP
CAPSULE
PHY
103a
102b
103b
IP
IP
CAPSULE
CAPSULE
PHY
PHY
102c
103b
103c
IP
IP
CAPSULE
CAPSULE
PHY
PHY
102d
103c
IP
IP
CAPSULE
CAPSULE
PHY
PHY
103d
102e
IP
IP
CAPSULE
PHY
PHY
102f
APPLI.
IP
PHY

FIG.22

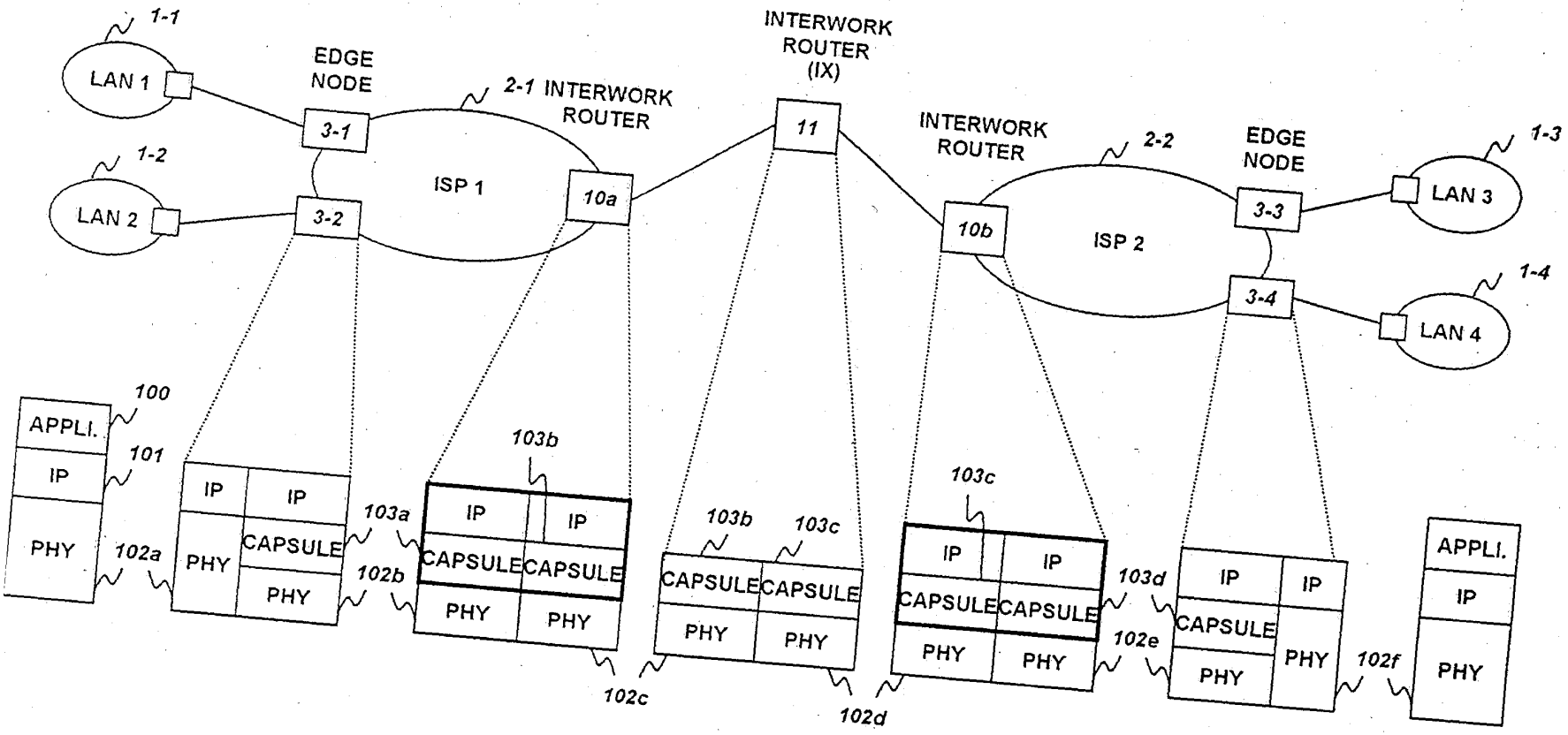
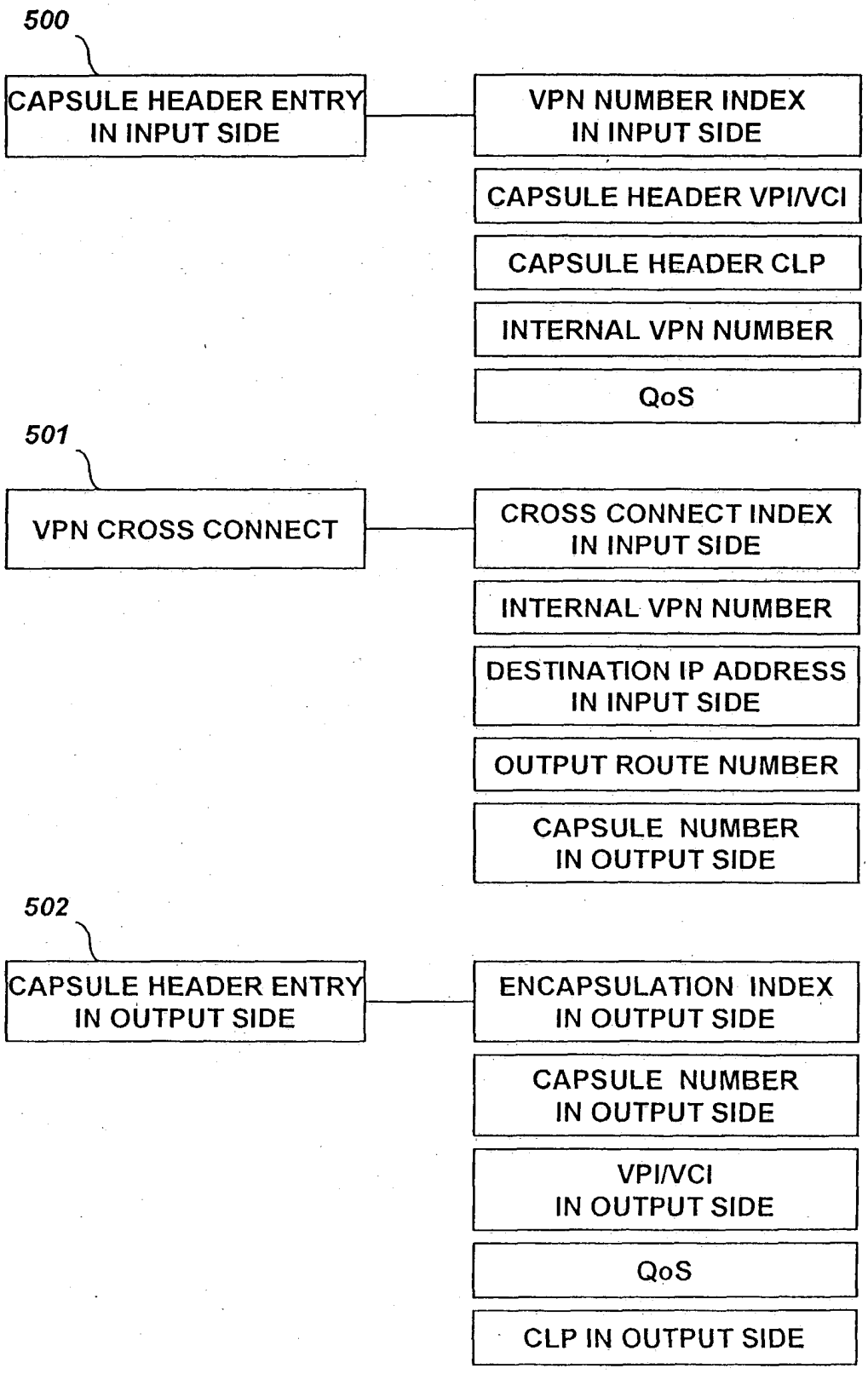

1-1
LAN 1
EDGE NODE
3-1
2-1 INTERWORK ROUTER
ISP 1
10a
INTERWORK ROUTER (IX)
11
INTERWORK ROUTER
10b
2-2
ISP 2
EDGE NODE
3-3
1-3
LAN 3
1-2
LAN 2
3-2
3-4
1-4
LAN 4
100
APPLI.
101
IP
PHY
102a
103a
CAPSULE
103b
102b
102c
103b
103c
102d
103c
103d
102e
102f
APPLI.

FIG.23


500
CAPSULE HEADER ENTRY IN INPUT SIDE
VPN NUMBER INDEX IN INPUT SIDE
CAPSULE HEADER VPI/VCI
CAPSULE HEADER CLP
INTERNAL VPN NUMBER
QoS
501
VPN CROSS CONNECT
CROSS CONNECT INDEX IN INPUT SIDE
INTERNAL VPN NUMBER
DESTINATION IP ADDRESS IN INPUT SIDE
OUTPUT ROUTE NUMBER
CAPSULE NUMBER IN OUTPUT SIDE
502
CAPSULE HEADER ENTRY IN OUTPUT SIDE
ENCAPSULATION INDEX IN OUTPUT SIDE
CAPSULE NUMBER IN OUTPUT SIDE
VPI/VCI IN OUTPUT SIDE
QoS
CLP IN OUTPUT SIDE